Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2007		**00-00-2007 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Making Underwater Gliders Useful to Navy Operations	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Southern California,Scripps Institution of Oceanography,La Jolla,CA,92093-0230**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**2**	

Making Underwater Gliders Useful to Navy Operations

PI: Russ E. Davis
M/C 0230, Scripps Institution of Oceanography
La Jolla, CA, 92093-0230
phone: (858)534-4415 fax: (858)534-9820 email: rdavis@ucsd.edu

co-PI: Daniel L. Rudnick
M/C 0213, Scripps Institution of Oceanography
La Jolla, CA, 92093-0213
phone: (858)534-7669 fax: (858)534-8045 email: drudnick@ucsd.edu

Grant Number: N00014-15-1-0364

LONG-TERM GOALS

The investigators' goal is to develop the capabilities of autonomous underwater gliders to be maintained and piloted at sea for periods of several months and to exploit this capability to address fundamental questions in ocean science.

OBJECTIVES

Underwater gliders are progressing from a developing technology to an operational tool. A major challenge now is to determine what tasks gliders are most suited to perform, a determination that is important to naval operation and to research application. Our objective is to quantify the capabilities of the Spray underwater glider in the field in both Navy and research applications.

APPROACH

In order to demonstrate the capabilities of Spray gliders for operational Navy applications, we are participating in surveillance exercises organized and carried out by the Naval Oceanographic Office. In these studies, we are typically given the general objectives that gliders are meant to accomplish (e.g. characterize sound speed structure in a particular region and time period), and we deploy and operate gliders to accomplish them.

To better test research capabilities, we are constructing a fleet of nine Sprays to be made available for ONR-sponsored oceanographic research studies. Spray gliders will be provided for use in the Non-Linear Internal Waves Initiative. These gliders are deployed offshore of the Phillippines south of the Luzon Strait, and are recovered off the east coast of Taiwan. Seagliders, provided by University of Washington in a collaborative effort, are deployed on the same schedule to double the size of the fleet sampling the Kuroshio.

Additional gliders will be built to comprise a fleet available for ONR projects after 2008. The management of this fleet will be determined as operational experience is gained.

WORK COMPLETED

One Spray was deployed near the Kuroshio from a Naval Oceanographic Office ship in September of 2005. The glider was deployed smoothly, operated without fault for 27 days producing 252 temperature and salinity profiles to 500 m, and was recovered without damage and with 3 months of energy remaining in the batteries. The data is under analysis at the Naval Oceanographic Office.

One Spray and one Seaglider were deployed in April 2007 and recovered in July 2007. The mission of over 100 days covered over 200 km, with over 400 dives to 1000 m. A second deployment in July 2007 of two Sprays and two Seagliders is due to be recovered in October 2007, when a third deployment will commence. A new recovery vehicle was used successfully on two occasions during the July recover from the R/V Melville.

Out of the planned fleet of nine Spray gliders, three have been built and delivered, and 6 are 75% complete. Delivery of total fleet is proceeding on a satisfactory pace.

RESULTS

In comparison with Slocum gliders, the Kuroshio showed the importance of reliability; a vehicle failure is very expensive in ship costs. A temporary functional limitation kept the Spray from diving below 500 m depth, and a comparison with a simultaneous Seaglider profiling to 1000 m showed the advantage of deep operations when trying to navigate in a region of strong surface-intensified currents.

During the April-October deployment, depth-average current was greater than 0.25 m/s (glider speed through water) over 20% of the time. In the presence of these strong currents, we were able to hit desired waypoints using a variety of flight control algorithms. Included in these algorithms are a set correction, and a technique of crossing especially strong currents that the glider cannot overcome.

IMPACT/APPLICATION

We have not yet learned the impact that glider data had on the acoustic products that the Naval Oceanographic Office was preparing in the Kuroshio operation.

HONORS/AWARDS/PRIZES

Russ Davis was selected the Monterey Bay Aquarium Research Institute 2006 Distinguished Lecturer and received the 2007 Prince Albert I Prize from the IUGG.